heavy rifled guns, in which an evenly burning product is an absolute necessity; and indeed the most important condition to be fulfilled in gunnery science is always to employ in a gun that powder which is best adapted to the arm. Now it is a well-known fact that the larger the grains of powder are made, the slower does a charge of it burn, supposing always the particles to be uniform in size, and not of a thin chip-like character, or irregular in shape. In rifled guns a slow, regular-burning powder is a *sine quâ non*, for, unlike the case of smooth-bore howitzers and mortars, a steady and increasing push, and not a violent jerk, is necessary to force the projectile through the grooves. For mortars, therefore, a comparatively fine-grain powder is employed, while for big rifled cannon a material of the coarsest description, with grains approaching in size that of a hazel nut, is invariably preferred.

The best charge for a gun, especially if rifled, is moreover that which increases in power as the shot passes through the bore, and which exerts its greatest force as the projectile leaves the muzzle, *but not earlier;* so that, on the one hand, the maximum explosive power is not put forth until the instant the mouth of the gun is reached and the last impetus given, while on the other hand no loss of power is suffered by the charge still burning after the bore is empty. If the charge burns quickly the shot is brought into action too rapidly, and the gun consequently subjected to excessive strain; whereas, if the combustion of the powder is too slow, the shot does not receive the full benefit of the charge, and a large portion of it is lost. Thus, as may easily be imagined, the difficulty has hitherto been to fix upon the precise description of charge necessary to the gun, and it is just this difficulty that has recently been solved by the elaboration of an instrument which accurately informs us of the velocity of any shot during its passage through the gun.

The possibility of discovering what takes place in the bore of a cannon at the time of its discharge, and of ascertaining how fast the shot travels, is a subject that has long attracted the attention of artillerymen, and among others that of a talented officer, Captain Andrew Noble, of the Elswick Ordnance Works. This gentleman's labours have recently been crowned with success; and an apparatus has been devised of which one hardly knows whether to admire more its exceeding delicacy or its wonderful results. With its aid the examination of gunpowder is now being conducted with comparative ease, and what is still more important, with unerring certainty.

A detailed description of the instrument, which has received the name of Chronoscope, would necessitate more space than we have here at our disposal, but its main features, and the principle upon which it is based, are easily explained. The tube or bore of a gun is fitted inside at certain intervals with metal rings (to the number of six or eight) the outside margins of which are sharpened into so many knife-edges. On a shot passing along the bore and through these rings, the edges of the latter are jammed down upon and made to cut through the ends of various insulated wires, one of which is placed under each ring. If we now suppose each of these wires to be in connection with an electric battery, it follows as a matter of course that as one wire after another is cut through, and the insulation consequently removed, an electric current passes; so that if there are six rings and wires fitted at intervals in the tube of the gun, the passage of a shot along it would be instrumental in producing six electric sparks following rapidly one upon the other.

We now understand how the shot is made to tell the tale of its flight; but there remains yet to be explained how the story is written down. This recording of the signals is accomplished by a very simple arrangement. A series of metal discs, one in connection with each wire, is made, by means of a clock-work arrangement, to revolve at a certain rapid velocity, say at the rate of 1,000 inches in a second; the surface of the discs is of polished silver, coated with lamp-black, and as soon as the desired speed has been attained, the gun, which is in electrical communication with the instrument, is fired. As the shot traverses the first ring, No. 1 wire is cut through, and a spark thereupon hops over to the recording disc, removing a little of the lamp-black covering, and thus marking the place by laying bare a minute spot of bright metal. No. 2 wire, when cut by the second ring, leaves a similar record upon another disc precisely in the same manner; and so on with Nos. 3, 4, 5, and 6, the relative position of the six spots on the six discs indicating exactly the velocity with which the shot has passed the six different rings or stations.

A very simple calculation is now necessary to get at the results; if there is a distance of one inch between each point, we know that one-thousandth part of a second has sufficed for the shot to travel from one ring to the other, for we remember that the discs were revolving at the rate of a thousand inches per second. This, however, only by way of example, for as a matter of fact we may mention that a shot usually takes from $\frac{1}{200}$th to $\frac{1}{300}$th of a second to traverse the whole length of the bore, its speed being somewhat slow when passing the first rings, and increasing as it approaches the muzzle of the gun.

A certain amount of correction is of course necessary when reading off the results, but the accuracy of these may at any time be verified. Thus, in order to ascertain whether the electric and mechanical arrangements of the discs are in good order, it would be necessary merely to place the whole number of wires together under a single ring, so as to be cut through at one and the same moment, when the points on the discs should, of course, all coincide.

The great importance of this beautiful invention need not be dilated upon by us, as the value of its aid in experiment is at once apparent to the veriest tyro in gunnery. As a measurer of time and speed of the most perfect character, its delicacy is certainly unsurpassed; for, by merely dividing every inch of the discs into a thousand divisions or degrees, we are at once enabled to calculate with precision to the millionth part of a second.

NOTES

A WEEK or two ago we announced a rumour to the effect that the Government had refused to allow a ship to convey the eclipse observers to Spain and Sicily next December. The rumour was too well founded; the Government has actually refused to tell off a ship for this purpose. This decision in the teeth of the plainest precedents requires no comment on our part; in fact, it is beyond all comment, it is astounding. We are enabled to announce, however, that the American Government, more enlightened than our own, are making extensive preparations; and upon the results of their labours and those of the Continental Governments Englishmen must therefore fall back, in a research which is eminently English. The Americans will send three corps of observation, to be stationed respectively at Malaga, Sicily, and some place in Turkey most available for making the best scientific records and views. One of these corps will be sent from the Naval Observatory, and the other two will be composed of the most scientific men in the country, including the professors from Harvard University. Before the war broke out it was arranged that Rear-Admiral Glisson should extend to the corps at Sicily all the aid and cooperation in his power. But the original plan has been spoiled for the present by the troubles in Europe, Admiral Glisson being obliged to move his squadron to the Baltic for the protection of American commerce in that vicinity.

WE regret to learn that the health of Gen. Sir E. Sabine, the distinguished and venerable president of the Royal Society, is at the present moment such that he is likely soon to demand relief from the pressure of those duties which he has hitherto performed with so much credit.

Before our next number is printed, the annual meeting of English *savants* will have commenced at Liverpool under the presidency of Professor Huxley, whose inaugural address we hope to give in our next issue. The meeting is likely to be one of great interest, and various circumstances will combine to bring together an unusual number of the representatives of every branch of science, including not a few of our foreign *confrères*, who we trust will enjoy the peaceful retreat from the turmoil on the Continent. Atomists and Non-atomists, Cataclysmists and Uniformitarians, Darwinians and Anti-Darwinians, will, for the moment, take the place of Gauls and Teutons—would that *their* differences could be as peacefully discussed! Some useless talk there doubtless will be, but we trust much earnest search after truth for truth's sake, and much evidence of real scientific work accomplished during the past year. We shall endeavour to give a report of the proceedings in the various sections, and to this end we must ask, and confidently expect to receive, the hearty co-operation of the Association itself, not only of the officers of sections, but of every individual member who takes part in the meeting.

The result of the experiments at Woolwich in reference to war balloons is that it has been found that a height of 100 fathoms at horizontal distance of 600 fathoms from the enemy would enable observers to secure the widest expanse of view. It is ascertained that captive balloons attain stability. The balloon having taken a stationary position, eight cameras and lenses spread round the country at equal distances enable the country to be photographed. The inclination and length of the cord to keep the balloon in the same stratum of air was found to be easily calculable. By the new system of military telegraphy for field service telegraph wires can be carried through the air from *terra firma* to a balloon, and the wire can be paid out as fast as the balloon sails; and two or more balloons can be kept in communication with each other, so that telegraphic operations can be made from the balloon to head-quarters and thence to the base of operations. It is believed that war balloons will be manufactured at the Royal Arsenal, and that officers of Royal Engineers will be trained in their use.

The *New York Technologist* for September describes a pocket rifle invented by Mr. Stevens. It is said to be capable of doing very accurate work, and the price is moderate. The method of loading is so simple that the weapon can be fired five times in a minute. By simply touching a spring the muzzle of the barrel drops down, leaving the breech exposed; a cartridge is then inserted, the barrel returned to its place, and the weapon is ready for use. For all light game they cannot be surpassed, and their penetration is considerable, driving the ball through three one-inch boards.

Mr. W. G. Smith has recently called attention to the great amount of heat generated by fungi, confirming Dutrochet's observation that it is greater in the case of *Boletus æneus* than of any other plant except the Arum. Mr. Smith believes that it is common to all *Boleti*, especially after decomposition has set in. Three large and beautiful specimens of *Boletus colopus* packed in a box were found by Mr. Smith to raise the temperature of the air from 70° to 75° Fahr., the heat evolved being apparent to the hand.

We gain some notion, says the *Gardener's Chronicle*, of what a siege means when we learn from Paris that the veteran director of the Jardin des Plantes, the well-known chemist, Chevreul—aptly called, from his researches into the nature of fatty substances, "the king of the fatty acids,"—has placed himself at the head of a brigade composed of *employés* of the Museum, and betaken himself to the fortifications. M. Delaunay, the Director of the Observatory, and M. Milne-Edwards, have marched to the scene of action at the head of nearly the whole of the officers and servants of the Academy of Sciences and the Museum. What should we think here in London if the chief librarian of the British Museum, with Professor Owen and Mr. J. J. Bennett as his *aides*, took the field with their subordinates and occupied Shooter's Hill, or if the director at Kew, with his staff, took upon themselves the defence of Richmond Hill? And yet this is what it has come to in Paris.

A sanitary council for Bohemia has been formed, consisting of Professors Jaksch, Halla, Kaulich, Town-District Surgeon Dr. Grosse of Prague, and District-Surgeon Dr. Hosier of Karolinenthal.

Mr. G. Farrer Rodwell has succeeded Dr. Debus as Lecturer on Natural Science at Clifton College.

The *Yale College Courant* states that Prof. Silliman has resigned his position as instructor of chemistry in that institution.

We are authorised to state that there is no foundation for the statement which appeared recently in one of the daily papers, that the London Institution in Finsbury Circus is likely to be removed in order to make room for a railway station.

The preparations for the Argentine National Exhibition at the city of Cordova are in active progress. The building is approaching completion, and the tramway to connect it with the railway station has been commenced. The tramways in the city have experienced great success, and caused an amount of building speculation in the suburbs beyond the available supply of labour. Several important railway proposals, involving prospective loans of magnitude, are under discussion in Congress.

Cornell University (for a notice of which see Nature, August 11) has recently acquired a fine and valuable collection of fossils from one of its many admirers in England. The educational value of such a collection in America, as illustrating the English geological works, is very great, and Cornell University may well be proud that it has so speedily received such a valuable gift.

It is proposed to found a Museum of History, Antiquities, and Arts, in the Central Park, New York. This movement is under the auspices of the New York Historical Society, and a grant of land has been given by the Government for that purpose. The plan embraces the erection of suitable buildings where historical relics and treasures of local and national interest may be deposited for preservation and exhibition.

Sig. Laranja e Oliveira forwarded to a recent meeting of the French Academy of Sciences an account of a very remarkable electric shock experienced at Porto-Alegre, Brazil, on the 9th of June. A thunderstorm was progressing at the time, and large drops of rain falling, with a light south breeze. At 100 metres from his own house, as a flash of lightning without thunder appeared over his head, one of Sig. Oliveira's servants felt a remarkable tingling through the whole of his body, ascending upwards from the soles of his feet, succeeded by a violent trembling; his hair stood on end, so as almost to throw off his hat. At the same time, at the distance of about two metres, white smoke ascended from the ground, accompanied by small consecutive flashes of lightning, but the whole lasting only an instant. A door key, which he had in his pocket, attracted for two days afterwards a needle suspended by a thread.

MM. Rabuteau and Peyre have been experimenting with the root of a plant in use at the Gaboon as an ordeal poison, and locally known as m'boundou or icaja. It will be remembered that it was from this source that the highly valuable Calabar bean was obtained and utilised in medicine. The authors state that, even in very dilute decoctions, it is very bitter, and appears to contain one or more alkaloids, since the aqueous decoction is largely precipitated by iodide of potassium, and also by phospho-molybdic acid. The poisonous effects of this substance bear some similarity to the effects of brucia; but the authors state that, under certain conditions this poison does not hurt men. Some of the lower animals are readily killed by it; a dose of three milligrammes of the alcoholic extract placed under the skin of a frog kills it; and rabbits and dogs are killed by doses of from 15 to 25 centigrammes of the same extract introduced into the stomach.

M. ROUSILLE, Professor of Chemistry in the Agricultural School of Saulsaie, describes a remarkable phenomenon witnessed by him on Mons Pilatus, at sunrise on July 19th. The air was foggy, the temperature 10·5° C., the barometer 647 mm., the altitude above the sea being 1288 metres. Whitish clouds appeared to form a crest to the mountain, the wind was light from the east, the sun at first very pale, obscured by a light cloud; but suddenly the sky appeared as if on fire, and at the same time the shadow of the mountain was projected on the horizon, at the same time that the image of the sun was reflected in the clouds to the west, surmounted by two rainbows, one above the other, and separated by a grayish band. The image of the sun was orange; the two rainbows which surmounted it consisted of two colours only, red and orange mingled together, and placed symmetrically in each of the rainbows with respect to the separating gray band. The upper bow was paler than the lower one. In proportion as the clouds approached the spectators, the image of the sun increased. At the same time that the rainbows became larger, some black lines became more and more clear, and were soon easily recognised as the shadows of the spectators. As the clouds advanced, the phenomenon disappeared three or four seconds before the spectators were enveloped in them; but the clouds again disappearing, the phenomenon was repeated three times successively in the space of eighteen minutes. The phenomenon appears to have been of the same nature as the well-known Spectre of the Brocken in the Hartz Mountains.

THE second part of Vol. I. of the Natural History Transactions of Northumberland and Durham has just been issued. The following are the most important papers contained in it:—A list of Freshwater Algæ collected in Northumberland and Durham (excluding Diatomaceæ and Desmidiæ) by Mr. G. S. Brady. On a new Labyrinthodont Amphibian from the Northumberland coal field; and on the occurrence in the same locality of *Anthracosaurus Russelli*, by Albany Hancock. The new Labyrinthodont, obtained from the Low Main seam of the Newsham colliery is a small species of Huxley's genus *Urocordylus*, and the name proposed is *U. reticulatus*, expressive of the reticulated structure of the surface of the cranial bones. On some curious fossil fungi from the Black Shale of the Northumberland coal field, by A. Hancock and T. Atthey (illustrated). The same authors contribute two papers (also illustrated) on the genera of fossil fishes *Climaxodus* and *Janassa*. Notes on the Entomostraca of Northumberland and Durham, by Mr. G. S. Brady (illustrated). The Meteorological and Climatological Reports for 1869, by the Rev. R. F. Wheeler, occupy a considerable portion of the volume, and are illustrated by tables and some very curious and interesting drawings of the solid residue left on evaporating rain-water, which fell in London, on the Clyde, at Manchester, and at Newcastle. The volume closes with the annual address to the members of the Tyneside Naturalists' Field Club, by the President, Rev. R. F. Wheeler.

DR. W. F. R. SURINGAR has contributed to the Annals of the Botanical Museum of Leyden a monograph of the Algæ of Japan, chiefly those collected by Von Siebold. The illustrations, both of the Diatomaceæ and the Sea-weeds, are of extreme beauty.

PROFESSOR HALFORD, of the University of Melbourne, in a paper read before the Medical Society of Victoria, has reviewed at length the history of twenty cases of snake-bite treated by his method of injecting liquor ammoniæ into the veins during the last eighteen months. These cases were all in the hands of different practitioners in the colony, who have each reported on them. Recovery followed in seventeen cases. In thirteen of these the practitioners in attendance expressly report that the patients were in a dying condition, and, in their belief, would soon have died, but for the employment of this remedy in the manner prescribed. The method employed was that introduced by Dr. Halford, and first brought to the knowledge of the profession here by him, in the pages of the *British Medical Journal*, through Mr. Paget; viz. by injecting dilute ammonia—say, at the least, thirty minims of the liquor ammoniæ B. P., specific gravity 959—into a superficial vein; the vein being first exposed, and its coats pierced with the nozzle of a hypodermic syringe. Dr. Dempster, Dr. Rae, Dr. Langford, Mr. Dallimore, and Dr. Meyler, each in his own words, and from the observation of separate cases, describe the curative effect as being immediate, and the recovery from collapse to be so rapid and startling as to be "almost magical." This method of treatment, of which such remarkable effects are detailed, has been sharply criticised; but Prof. Halford successfully vindicates the claim of the snakes to be considered highly venomous—almost as much so, he intimates, as some of his London critics. They included the tiger-snake, the brown and black snake of Australia, which are affirmed to be as deadly as the cobra and rattle-snake of India. Strong testimony to the efficacy of the treatment in saving life was borne by Australian practitioners who took part in the discussion, and vindicated Prof. Halford's claim to be considered as the discoverer of a means of rescuing many from an otherwise inevitable death.

A VALUABLE addition to scientific literature has been lately published in Boston, viz.: "Alaska and its Resources," by Mr. W. H. Dall, the director of the Scientific Corps of the late Western Union Telegraph Expedition. This work throws much light upon the flora and fauna of this little visited and comparatively unknown portion of America, lately acquired by the United States Government.

F. MULHAUSEN, civil engineer of Brunswick, has invented, according to the *British Medical Journal*, a new freezing and ventilating machine of remarkable ingenuity. The cold is produced by the mechanical expansion of atmospheric air. It produces, when in operation, any desired degree of cold, freezes water without the use of any chemical agents, and will effectually cool and ventilate any apartment or building, on whatever scale, large or small. In hospitals, especially in tropical climates, where the production of ice and the cooling of the air are often matters of great urgency, and always of great value, in theatres and workshops, and in our new Indian barracks, such a machine will be of infinite value. The London theatres can hardly afford to be without it. The labour of one man, with a small 5-horse motor power machine, will produce 100lb. of ice an hour, and cool 15,000 cubic feet of air from 30° to 50° below Reaumur (*sic* in *B.M.J.*) The production of pure ice, for the purpose of cooling our drinking-water and furnishing a cheap mode of replenishing our domestic refrigerating safes during the hot season, will be a great addition to the sum of comfort in London life. Cheap ice will be especially a great boon to the hospital and sick-room; nothing is so refreshing for the parched lips of the sick man. If it were not so costly as it now is, ice would be very largely used in all hospitals, and would be an infinite boon to the sick.